54. The Inner Structure of the Calorized Layers on Carbon Steel.

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The inner structure of the calorized layers (0.3 mm in thickness) on carbon steel (containing 0.5 % of C) were examined with X-rays. In this examination, the specimens mostly used, were prepared by the pack calorizing method at a temperature 950°C~1200°C for 4 hrs.. The details of this experiment, and the experimental results obtained with a back-reflection camera utilizing Fe K_α and Fe K_β radiations were given in the annexed table.

No. of Specimens	Active Ingredient Flux				Condition of the Alluminized Surface.
	47% Al-Fe Alloy	Al_2O_3	Al	NH_4Cl	
I	27.8 %	18.85 %	50.25 %	3.1 %	Lustrous aud enduring for thermal as well as mechanical infections.
II	72.8 %	23.7 %	0	3.5 %	Though not quite, so lustrous, comparing well with specimen I in the other respects.
III	0	0	99.0 %	1.0 %	Rugged and easilly spalled.
Remark: Percentages are given in volume.					

Table (continued)

No. of Specimens	Atomic Planes of the Substances corresponding to the Observed Spectral Lines.	
I	The layers except for the innermost one:	Fe_3Al $(400)_\alpha$ αFe $(220)_\alpha$
	The innermost boundary layer:	4 % Al-Fe $(220)_\alpha$ 4 % Al-Fe $(310)_\beta$
	The surface of parent carbon steel:	αFe $(220)_\alpha$ Fe_3C $(413)_\alpha$
II	The outer most layer:	4 % Al-Fe $(220)_\alpha$ 4 % Al-Fe $(310)_\beta$
III	Up to considerable depth, the aluminized surface gave rise to 3 strong and 1 weak lines, but the indices of the corresponding atomic planes could not be determined.	

By comparing the experimental results with the phase diagram of Fe-Al system, it can be seen that the outermost surface of the parent material is of a pearlite structure, in which same C atoms of cementite are removed due to the impregnation of Al atoms. The calorized layers of Specimen I, being mostly composed of Fe_3Al mingled a small quantity of ferrite, they are infered to contain 17 %~18 % of Al.

This inference could also be confirmed by the examination of the magnetic property. In specimen II, even the outermost layer was found to be made up by ferrite contaning 4 % of Al, similarly as in the innermost layer of Specimen I adjoining to the surface of the parent carbon steel. The lines reflected from Specimen III, are deemed to show the presence of the intermediate phase as $FeAl_3$, the lattice type of which has not yet been determined. Such a supposition seems to be allowable, as the surface of Specimen III, displays some greenish blue colour by pickling in a dilute NaOH solution.

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55. On the Desulfurization in the Hearth of the Blast Furnace.

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The quantity of sulphur contained in iron and Steel influences the quality of their products. Desulphurization has therefore been admitted to be important in blast furnace operation, but rarely specified for the fundamental study in the hearth up to date.

The desulfurizing reaction is taken for the following formula.

$$FeS + CaO + C = Fe + CaS + CO$$

H. Sawamura and K. Sawada caluculated for the sulphur equilibrium between molten slag and metal in the hearth as follows:

$$\log (CaS)/[Fes] = \log K_3 + \log (CaO) + \log [C]_s - \log P_{CO}$$

$$\log K_3 = -7050/T + 6.46 - \log 87.90/72.14 + \log (0.588 \cdot 10^{-4}\, t^{\circ}C - 0.0793) - 0.05(\sum SiO_2)$$

The above has proved that the desulphurization in the hearth was influenced by the quantity of $(\sum SiO_2)$, (CaO), $[C]_s$, P_{CO} at a constant temperature. We shall determine the relation between P_{CO}, slag components and pig components which infulence the desulphurization.

2) Sample.

A. metal: High carbon pig iron with nearly no impurity.

B. slag: molten range of Al_2O_3-SiO_2-CaO system when containing 10 % Al_2O_3 is $0.4 \sim 1.2 (\sum CaO/\sum SiO_2)$ at 1400°C. Accordingly a series of five slags containing 10 % Al_2O_3 and 1.5 % S was melted in a graphite crucible.

3) Experimental Apparatus and Procedure.

Putting a graphite crusible charged with 5 gr slag, 12 gr pig iron and a proper quantity of metallic Si, into a high Aluminium Tammann tube (vacuumed) in a